

FLOOD PLAIN INFORMATION

**WALLA WALLA RIVER
VICINITY OF MOJONNIER
WALLA WALLA COUNTY,
WASHINGTON**



**PREPARED FOR WALLA WALLA COUNTY BY THE DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS, WALLA WALLA, WASHINGTON**

FEBRUARY 1976

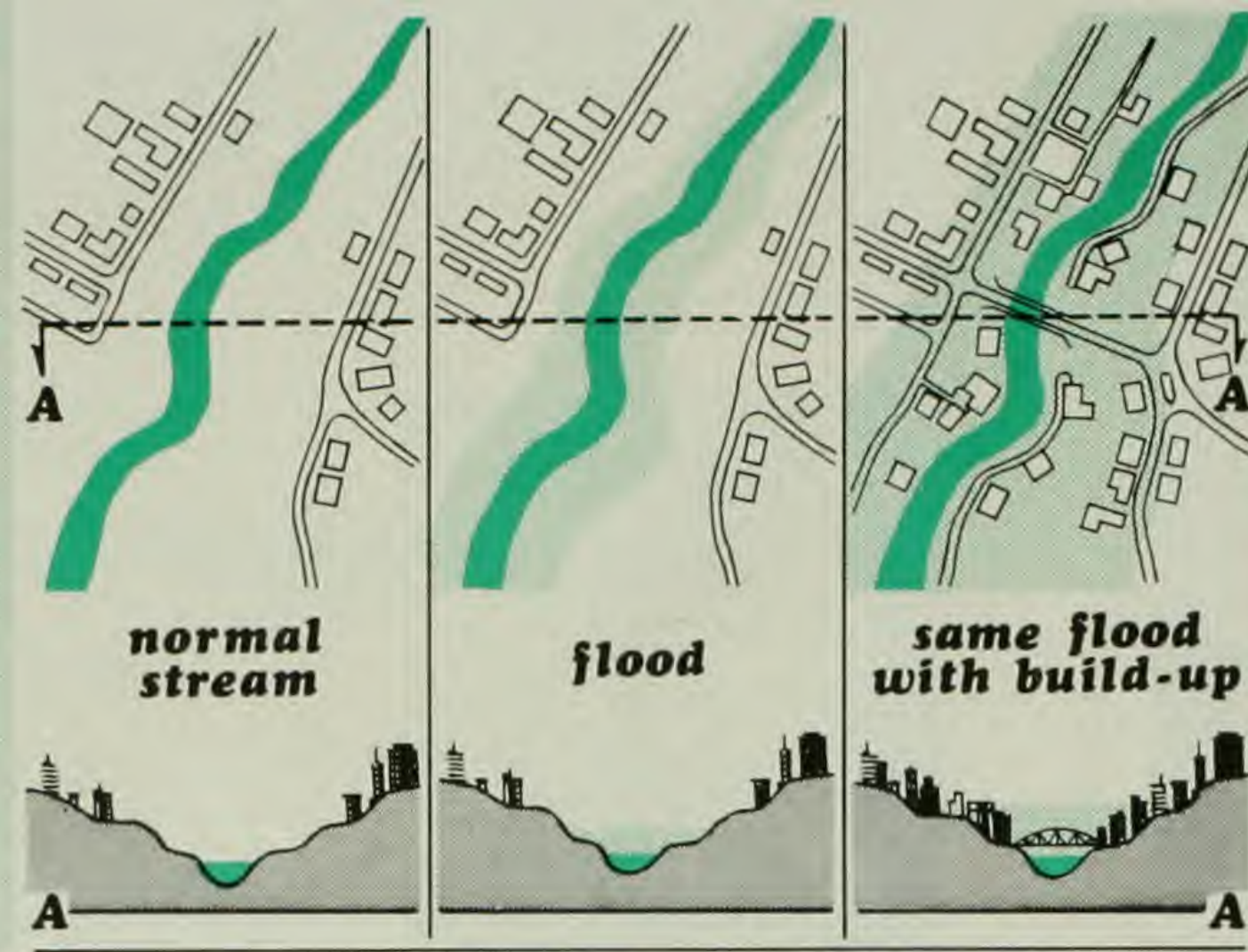
FLOODS

WALLA WALLA RIVER
VICINITY OF MOJONNIER
WALLA WALLA COUNTY
WASHINGTON

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BUILDING
in the
FLOOD PLAIN
can make
FLOODS
WIDER
and
DEEPER



this
ENCROACHMENT
can change
a
Small Flood
into a
MAJOR FLOOD

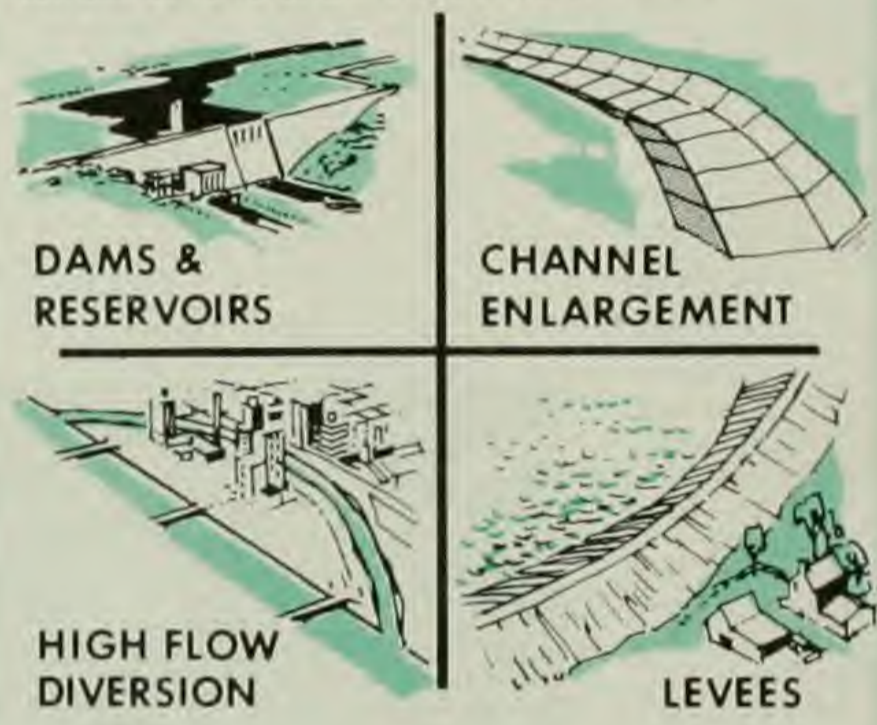
TOOLS of FLOOD PLAIN MANAGEMENT for the reduction of Flood Damage and Human Suffering



MEASURES TO REDUCE VULNERABILITY TO FLOODS provide for a future with more freedom from flood damage, often at minor cost and with little adverse effect on the environment

REGULATIONS
(ZONING, BUILDING CODES, SUBDIVISION)
• FLOOD PROOFING • RELOCATIONS •
• URBAN RENEWAL •

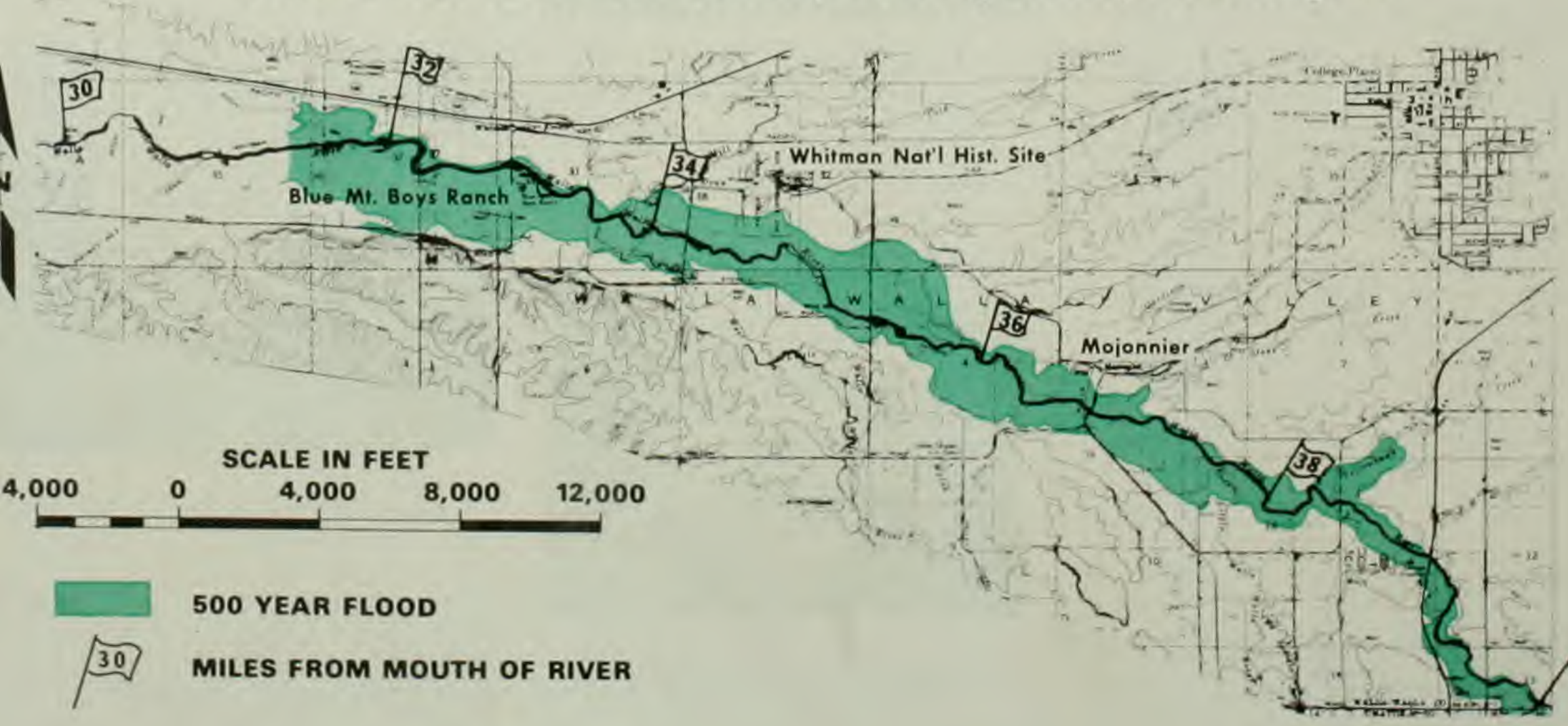
MEASURES TO MODIFY FLOODS
are often required to alleviate existing problems and sometimes to forestall future problems . . .



OTHER MEASURES
aid the Flood Plain occupant in coping with floods . . .

- EDUCATION
- TAX ADJUSTMENTS
- FLOOD INSURANCE
- WARNING & EMERGENCY PLANS

FLOOD PATTERN for vicinity of Mojonnier, Washington



Flood Magnitude
Flow-cfs*
Below confluence of Mill Creek
Large (100 year flood) 18,000
Very Large (500 year flood) 35,000
* Cubic feet per second

HIGHEST FLOODS ANTICIPATED ON WALLA WALLA RIVER

This folder is an announcement of and supplement to the "Flood Plain Information (FPI) Report, Walla Walla River, Vicinity of Mojonner, Walla Walla County, Washington." The report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. Although extensive flooding has occurred in the past, studies indicate that even larger floods can occur in the future. Emphasis is given to future floods in the FPI Report. Maps, profiles and cross sections have been included to illustrate the possible extent and severity of future floods. Included in this folder are photographs showing future flood heights at selected locations.

FLOODS on Walla Walla River

FLOODS

WALLA WALLA RIVER
VICINITY OF MOJONNIER
WALLA WALLA COUNTY
WASHINGTON



AERIAL VIEW OF FLOODING ON WALLA WALLA RIVER NEAR MOJONNIER.



AERIAL VIEW OF FLOODING IN VICINITY ABOVE PEPPER'S CROSSING BRIDGE.



AERIAL VIEW OF FLOODING IN THE VICINITY OF THE ROAD TO THE WHITMAN NATIONAL HISTORICAL SITE NEAR R.M. 34

POTENTIAL FLOOD HEIGHTS AT THE WHITMAN NATIONAL HISTORICAL SITE



POTENTIAL FLOOD HEIGHTS AT THE BLUE MOUNTAIN BOY'S RANCH



Inside are sketches illustrating the horizontal and vertical relationships of flooded areas and a flood area map from the report showing the extent of a very large flood (500 Year).

ACTION is Needed

The Walla Walla River flood plain in the vicinity of Mojonner, Walla Walla County is a well-developed agricultural area with expansion expected in the future. Damaging effects of flooding will continue unless action is taken.

Effective regulatory measures, such as zoning ordinances and building codes, are designed to prevent increased flood damages. Flood-proofing can reduce potential damage to properties already subject to flooding, and additional work to modify flooding can also be a part of the long-run solution.

Walla Walla County is not the only area with flooding problems. Flood plain information has been provided for many flood-plagued communities. Over 1,000 of those having FPI Reports by mid-1974 have adopted or strengthened regulations, while 1,100 others have them under study. An additional 1,500 communities have used the FPI Reports to establish interim land use control.

This folder has been prepared for the Walla Walla County Commission by the U.S. Army Corps of Engineers from data in the report, "Flood Plain Information, Walla Walla River, Vicinity of Mojonner, Walla Walla County, Washington." Copies of the report and this folder are available on request from the Walla Walla County Commissioners, County Courthouse, Walla Walla, Washington. 99362

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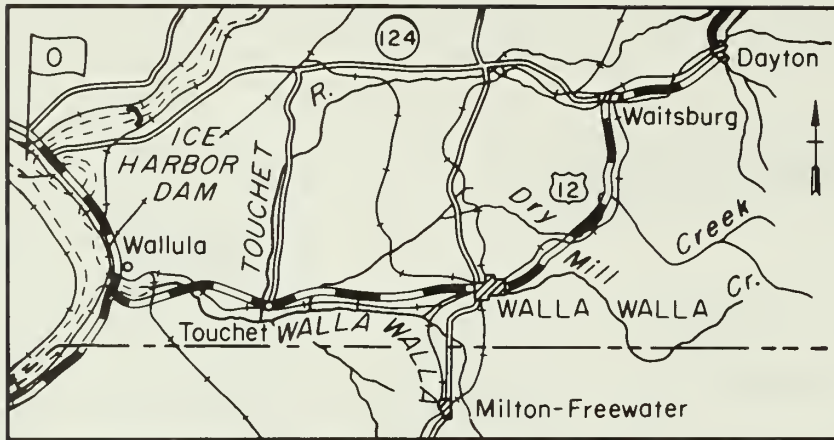
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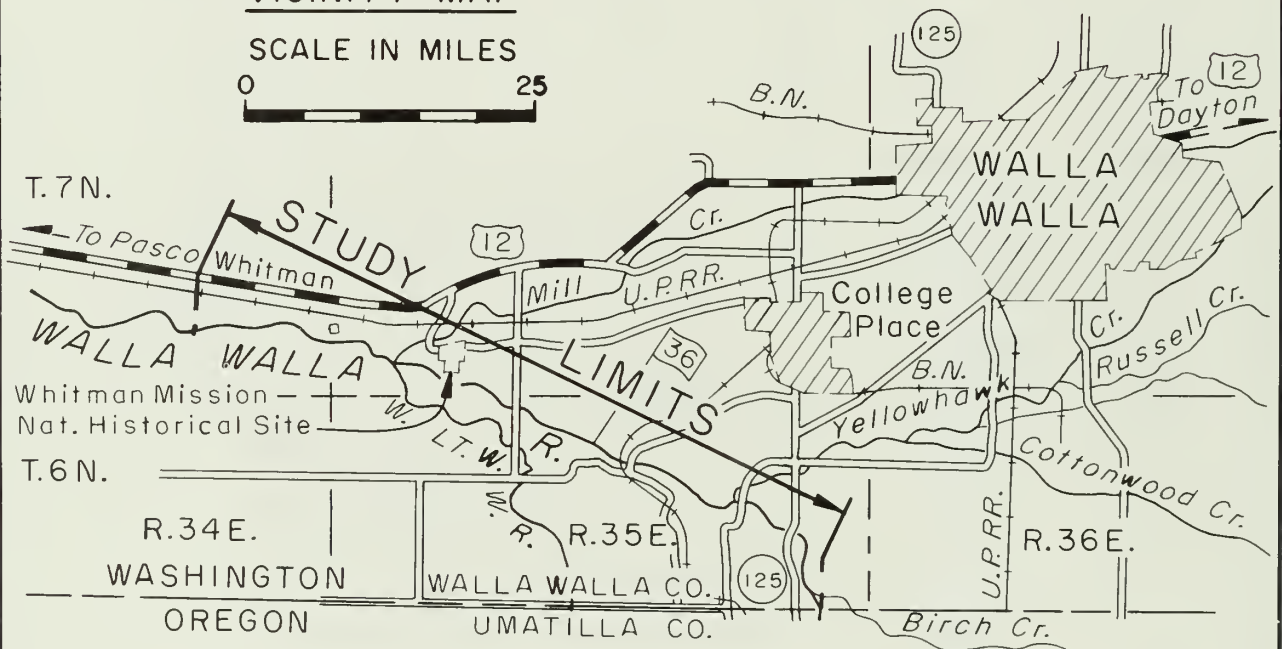
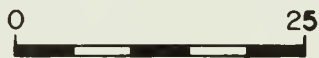
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VICINITY MAP

SCALE IN MILES



WALLA WALLA CO., WASH.
T. 7 N; R. 34 & 35 E.

CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT

GENERAL MAP

WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE

PREFACE


The Walla Walla Valley is subject to flooding from the Walla Walla River. The properties on the flood plains along this stream are primarily residential and agricultural and have been damaged by the floods of 1931, 1964, and 1965. The open spaces in the flood plain which may come under pressure for future development are extensive. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. It includes some history of flooding in the drainage and identifies areas that are subject to possible future floods. Special emphasis is given to these floods through maps, photographs, profiles, and cross-sections. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments including flood proofing which might be embodied in an overall Flood Plain Management (FPM) program. Other FPM program studies--those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings--would also profit from this information.

At the request of Walla Walla County and indorsement of the Washington State Department of Ecology, this report was prepared by the Walla Walla District Office of the Corps of Engineers, Department of the Army under continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of Walla Walla County and private citizens in supplying useful data and photographs for the preparation of this report are appreciated.

Additional copies of this report can be obtained from Walla Walla County. The Walla Walla District Office of the Corps of Engineers, Department of the Army, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented as well as planning guidance and further assistance, including the development of additional technical information.



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BACKGROUND INFORMATION

Walla Walla County (Vicinity of College Place)

Settlement:

This part of the Northwest was initially explored by the 1804-1806 Lewis and Clark expedition. Some fur trappers entered the area after trading posts were established along the lower Columbia River in the early 19th century, but no significant settlement developed until the arrival of missionaries about 1836. The Marcus Whitman Mission at Waiilatpu on the Walla Walla River was the most important to this area. It did much to foster permanent settlement in the Walla Walla Valley. Farming and other enterprise developed around this mission to serve its needs and those of the emigrants passing through on their way to the Oregon Coast.

Military posts were established to affirm U.S. control of the region, following a massacre by Indians at the Whitman Mission.

Although these military posts resulted in additional settlement and economic activity, it was gold discoveries along the Clearwater, Powder, and John Day Rivers that brought the major influx of miners and settlers into this part of the region. The City of Walla Walla became an important regional trading and distributing center. Wheat farming began in the late 1870's and flourished, along with other economic activity as settlement increased and transportation systems developed.

Walla Walla College was established by the Seventh Day Adventist Church in 1892, near the City of Walla Walla. The City of College Place developed around this nucleus, and in 1970 its population had increased to 4,510. Much of this city's economic and social activity is centered around the college and education. It also serves as a dormitory area

for some who commute to work in other cities.

The Stream and Its Valley:

TABLE 1

DRAINAGE AREAS

Location	<u>Drainage Area</u> Sq. mi.
Walla Walla River at Oregon-Washington Stateline	180
Walla Walla River near Whitman Station	401

The climate is characterized by warm to hot summers, when temperatures may rise above 100 degrees, and cool winters, when temperatures reach below zero degrees with an annual average temperature of 54.7 degrees. Annual precipitation over the basin averages 23 inches with a major portion occurring in spring and winter of the year.

Developments in the Flood Plain:

Developments in the flood plain are primarily agriculture but includes residential, commercial developments and the Whitman National Historic Site. Commercial developments include dairies and green houses.

The Walla Walla Valley Railroad traverses part of the valley and there are numerous county and private roads that provide access all along the river valley.

FLOOD SITUATION

Sources of Data and Records:

The U. S. Geological Survey has a stream gage on the Walla Walla River near Touchet, which has been in operation since 1951. A stream gaging station has been maintained by U. S. Geological Survey on the North Fork, Walla Walla River since 1969 and one on the South Fork, Walla Walla River since 1931. These gages are located about fourteen miles downstream of and sixteen and nineteen miles upstream of the study area, respectively.

To supplement the records at the gaging stations, newspaper files, historical documents and records were searched for information concerning past floods. These records have developed a knowledge of floods which have occurred on the Walla Walla River.

Maps prepared for this report were based on aerial photographs. Structural data on bridges was obtained by field surveys under the jurisdiction of the Corps of Engineers, Walla Walla District.

Crest stages and discharges for known floods at the gaging station on Walla Walla River near Touchet are shown in TABLE 2.

TABLE 2
FLOOD CREST ELEVATIONS

Date of Crest	Estimated Peak <u>Discharge</u> cfs	Stage ¹ feet	Elevation ²
22 December 1964	33,400	18.90	423.90
30 January 1965	15,800	13.72	418.72

¹ Overbank flooding begins at a stage of 10.00 feet.

² Feet, mean sea level datum.

Flood Season and Flood Characteristics:

Major floods have occurred in the study reach of the Walla Walla River during the winter season of the year with the greatest recorded flood occurring in December 1964. Floodflow stages can rise from normal flow to extreme flood peaks in a relatively short period of time with high velocities in the main channel of the streams.

In addition to floods caused by runoff from general rainfall, the Walla Walla Valley is susceptible to spring floods from snowmelt in combination with rainfall.

Factors Affecting Flooding and Its Impact:

Obstructions to floodflows: Natural obstructions to floodflows include trees, brush, and other vegetation growing along the streambanks and in floodway areas. Man-made encroachments on or over the streams, such as dams and bridges can also create more extensive flooding than would otherwise occur. Representative obstructions to floodflows are shown in Figures 1 and 2.

During floods, trees, brush and other vegetation growing in floodways impede floodflows, thus creating backwater and increased flood heights. Trees and other debris may be washed away and carried downstream to collect on bridges and



Downstream view of Last Chance Road Bridge at Cross Section 22.



Downstream view of bridge to Mojonnier at Cross Section 32.



Downstream view Pepper Crossing Bridge at Cross Section 55.

other obstructions to flow. As floodflow increases, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge until the load exceeds its structural capacity and the bridge is destroyed. The limited capacity of obstructive bridges retard floodflows and result in flooding upstream, erosion of bridge approach embankments, and possible damage to the overlying roadbed.

In general, obstructions restrict floodflows and result in overbank flows and unpredictable areas of flooding, destruction of or damage to bridges, and an increased velocity of flow immediately downstream. It is impossible to predict the degree or location of the accumulation of debris; therefore, for the purposes of this report, it was necessary to assume that there would be no accumulation of debris to clog any of the bridge openings in the development of the flood profiles.

The Walla Walla River is spanned eight times by bridges. Pertinent information on all bridges can be found in TABLE 4 on Page 19. Most of these bridges are obstructive to floodflows.

Flood Damage Reduction Measures:

There are existing county zoning ordinances, building codes, and other regulatory measures for the reduction of flood damages. This study has been requested because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization.

Other Factors and Their Impacts:

Flood Warning and Forecasting: The National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions in the Walla Walla area. Flood warnings and anticipated weather conditions are issued

by the National Weather Service to city officials, radio and television stations, and the local press media for further dissemination to residents of the area. Flood warning for the area is carried out by the Department of Operations and Public Safety working with Civil Defense agencies. When the National Weather Service's forecasts indicate high water stages could be expected, observations of river stages are made at the USGS gaging station near Touchet, Washington which is approximately 12.5 River Miles downstream of the study area.

Flood_Fighting_and_Emergency_Evacuation_Plans: Although there are no formal flood fighting or emergency evacuation plans for the area, provisions for alerting area residents and coordinating operations of city and county public service agencies in time of emergency are accomplished through the Walla Walla County Civil Defense Office. This office maintains communication with the State Civil Defense Headquarters National Weather Service at its control center and establishes a "flood watch" during the earliest stages of a flood threat. Subsequent flood fighting, evacuation and rescue activities are coordinated on the county-wide basis with local public agencies.

Material_Storage_on_the_Flood_Plain: Some agricultural crops and farm equipment form most of the floatable materials stored on flood plain lands. In addition, throughout the area there are some buildings, storage tanks and containers which may be unrestrained and buoyant. During time of floods, these floatable materials may be carried away by floodflows causing serious damage to structures downstream and could clog bridge openings, creating more hazardous flooding problems.

PAST_FLOODS

Summary_of_Historical_Floods:

Damaging floods have been reported to have occurred in the Walla Walla Valley area as early as 1906. Floods causing significant damage are described to have occurred in 1906, 1931, 1964 and 1965. Among these, the 1965 flood was the highest of record on the Walla Walla River.

Flood_Records:

Information on historical floods in the Walla Walla Valley area was obtained from stream gaging stations maintained by the U.S. Geological Survey at three locations within the Walla Walla River watershed near the study area. High water marks of the January 1965 floods were obtained.

Flood_Descriptions:

The following are descriptions of known large floods that have occurred in the vicinity of College Place and Walla Walla:

1931_Flood - The following excerpt is from the "Milton Eagle" dated 2 April 1931:

"Travel is at a standstill between the City and outside points.... However, reports indicate that every bridge over the river in this district is damaged, chiefly by washing out of the approaches."

1964_Flood - The following excerpt is from the "Walla Walla Union Bulletin" dated 23 December 1964:

"Torrents of water poured over the Walla Walla County Wednesday causing an estimated \$500,000 or more damage to county roads and bridges.----- Walla Walla County was virtually isolated Wednesday with only the Walla Walla - Pendleton highway open and no place to go after arriving in Pendleton.----- County Engineer B. Loyal Smith said every road in Walla Walla County was hit by the flood.----- Some of the more recent county bridges damaged by the storm included the Hart bridge over the Touchet River near Prescott and the Pepper's Crossing span over the Walla Walla River south of the city."

1965_Flood - The following excerpt is from the "Postflood Report, December 1964, January 1965, Spring 1965 Walla Walla

District," U.S. Army Engineer District, Walla Walla,
Washington, January 1966:

"The January flood developed a little slower, was primarily from overbank flows in normal water courses, and in most areas the peaks were not as high. The exception was Walla Walla River at Milton-Freewater which exceeded the December peak. Levees throughout the town were severely taxed, but flood fight prevented failure and also prevented flooding via the irrigation facilities as happened in December."



Aerial view of flooding in vicinity of Highway 125 Bridge.
Crest of flood passed earlier.



Aerial view of flooding in vicinity above Pepper Crossing
Bridge. Crest of flood passed earlier.



Aerial view of flooding downstream of Mojonnier Bridge. Crest of flood passed earlier.



Aerial view of flooding in vicinity of road to Whitman National Historic Site. Mill Creek enters at right. Crest of flood passed earlier.



Aerial view of flooding in vicinity of Mojonier. Crest of flood passed earlier.



Aerial view of flooding in vicinity Blue Mountain Boy's Ranch. Crest of flood passed earlier.

FUTURE_FLOODS

Floods of the same or larger magnitude as those that have occurred in the past could occur in the future. Larger floods have been experienced in the past on streams with similar geographical and physiographical characteristics as those found in the study area. Similar combinations of rainfall and runoff which caused these floods could occur in the Walla Walla River area. Therefore, to determine the flooding potential of the study area, it was necessary to consider storms and floods that have occurred in regions of like topography, watershed cover and physical characteristics. Discussion of the future floods in this report is limited to those that have been designated as the 100-Year Flood and the 500-Year Flood. The 100-Year Flood may reasonably be expected to occur more frequently although it will not be as severe as the infrequent 500-Year Flood.

100-Year_Flood:

The 100-Year Flood is defined as one that could occur once in 100 years on the average, although it could occur in any year. The peak flow of this flood was developed from statistical analyses of streamflow and runoff characteristics for the stream under study. However, limitations in these records required analyses on a regional rather than a watershed basis. In determining the 100-Year Flood for the Walla Walla River study area, statistical studies were made using up to 44 year's record of flood data from U.S. Geological Survey gaging stations throughout the Walla Walla River drainage. Peak flows thus developed for the 100-Year Flood at selected locations in the study area are shown in TABLE 3. The relative water surface elevations for the 100-Year flood are shown on Plates 6 through 8.

500-Year Flood:

The 500-Year Flood is defined as one that could occur once in 500 years on the average, although it could occur in any year. The peak flow of this flood was developed from statistical analyses of streamflow and runoff characteristics for the stream under study. However, limitations in these records required analyses on a regional rather than a watershed basis. In determining the 500-Year Flood for the Walla Walla River, statistical studies were made using up to 44 year's record of flood data from the U.S. Geological Survey gaging stations throughout the Walla Walla River drainage. Peak flows thus developed for the 500-Year Flood at selected locations in the study area are shown in TABLE 3. The relative water surface elevations for the 100-Year Flood and the 500-Year Flood are shown on Plates 6 through 8.

TABLE 3
PEAK FLOWS
FOR 100-YEAR AND 500-YEAR FLOODS

Location	River Mile	Drainage Area Sq. mi.	100-Year Flood Discharge cfs	500-Year Flood Discharge cfs
Below Birch Creek	39.9	220.0	12,800	26,000
Below Yellowhawk Creek	37.9	285.0	14,600	29,000
Below Mill Creek	33.6	401.0	18,000	35,000

Recorded discharges for the 1965 flood at the gage near Touchet on the Walla Walla River was 15,800 cfs.

Frequency:

A frequency curve of peak flows was constructed on the basis of available flood peak information. The frequency curve thus derived, which is available on request, reflects

the judgment of engineers who have studied the area and are familiar with the region; however, it must be regarded as approximate and should be used with caution in connection with any planning of flood plain use. Floods larger than the 500-Year Flood are possible but the combinations of factors necessary to produce such large flows would be extremely rare.

Hazards of Large Floods:

The extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. A 100-Year or 500-Year Flood on the Walla Walla River would result in inundation of some residential and agricultural sections in the study area. Deep floodwater flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater three or more feet deep and flowing at a velocity of three or more feet per second could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed, or in vehicles that are ultimately submerged or floated. Water lines can be ruptured by deposits of debris and the force of floodwaters, thus creating the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters, creating health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded Areas and Flood Damages: The areas in the study area that would be flooded by the 500-Year Flood are shown on Plate 2, which is also an index map to Plates 3 through

5. Areas that would be flooded by the 100-Year and 500-Year Floods are shown in detail on Plates 3 through 5. The actual limits of these overflow areas may vary somewhat from those shown on the maps because the 10 foot contour interval and scale of the maps do not permit precise plotting of the flooded area boundaries. As may be seen from these plates, floodflows from the Walla Walla River cover large portions of the valley floor. The highest stages of flooding throughout the study area occur when the floodwaters from the Walla Walla River meet with the high stages of Mill Creek, Yellowhawk Creek and Birch Creek. The areas that would be flooded by the 100-Year and 500-Year Floods include residences, farm outbuildings, some commercial developments, private and public roads, and private and public utilities. Considerable damage to these facilities would occur during a 100-Year Flood. However, due to wider extent, greater depths of flooding, higher velocity flow and longer duration of flooding during a 500-Year Flood, damage would be even more severe than during a 100-Year Flood. Plates 6 through 8 show water surface profiles of the 100-Year and 500-Year Floods. Depth of flow in the channel can be estimated from these illustrations. Typical cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the 100-Year and 500-Year Floods are shown on Plate 9.

Obstructions: During floods, debris collecting on bridges could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the 100-Year and 500-Year Floods. Similarly, the maps of flooded areas show the backwater effect of obstructive

bridges, but do not reflect increased water surface elevation that could be caused by debris collecting against the structures, or by deposition of silt in the stream channel under structures. As previously indicated, there are no dams within the study area which have flood control capacities. Of the eight bridges crossing the stream in the study area, most of them are obstructive to the 100-Year Flood and even more are obstructive to the 500-Year Flood. In some cases bridges may be high enough so as not to be inundated by floodflows; however, the approaches to these bridges may be at lower elevations and subject to flooding and rendered impassable. TABLE 4 lists water surface elevations at all bridges, most of which are restrictive during floodflows.

TABLE 4
BRIDGES ACROSS WALLA WALLA RIVER

Identification	Miles Above Mouth	Under- clearance Elevation ¹	<u>Water Surface Elevation</u>	
			100-Year Flood	500-Year Flood
Detour Road Bridge	33.0	582.6	583.5	584.4
Whitman Mission Road Bridge	34.0	609.6	611.0	612.8
Last Chance Road Bridge	35.3	642.6	644.5	650.0
Walla Walla Valley Railroad Bridge	36.6	682.0	679.0	687.0
Mojonnier Bridge	36.6	683.9	683.0	688.5
Old Milton Highway Bridge	37.9	730.6	731.5	735.5
Highway 125 Bridge	38.2	744.0	747.0	754.5
Pepper's Crossing Bridge	39.6	769.9	772.0	775.0

¹ Feet, mean sea level datum.

Velocities of Flow: Water velocities during floods depend largely on the size and shape of the cross sections, conditions of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream. During a 100-Year Flood, velocities of main channel flow in the upper reaches of the streams in the study area would be 6 to 16 feet per second. Water flowing at this rate is capable of causing severe erosion to streambanks and fill around bridge abutments and transporting large objects. In the lower reaches, the velocities would be somewhat lower averaging 5 to 12 feet per second. It is expected that velocity of flow during a

500-Year Flood would be slightly higher than during a 100-Year Flood. Overbank flow in the study area would average one to five feet per second. Water flowing at two feet per second or less would deposit debris and silt.

Rates of Rise and Duration of Flooding: Intense rainfalls that accompany severe storm fronts usually produce the floods occurring in the study area. There is a time lag of at least several hours to two days before overbank flooding occurs in the study area. Floods generally rise moderately fast and stay out of banks for one to three days. TABLE 5 gives the probable maximum rates of rise, height of rise, time of rise (time period corresponding to height of rise, and duration of critical stage (period of time flood is above critical stage level)) for the 100-Year and 500-Year Floods.

TABLE 5

PROBABLE RATES OF RISE AND DURATION

Flood	Maximum Rate of Rise ft/hr	Height of Rise ft	Time of Rise hrs	Duration of Critical Stage hrs
100-Year Flood	1	10	24	48
500-Year Flood	1	12	24	48

Photographs, Future Flood Heights: The levels that the 100-Year and 500-Year Floods are expected to reach at various locations in the study area are indicated in the following photographs:



Flood heights at home 250 feet south of
bridge to Whitman National Historical Site.



Flood heights at Hamada Brothers
Greenhouse.



Flood heights in front of Blue Mountain Boys' Ranch.

GLOSSARY

Backwater. The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Plain. The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the

reach or area in which the elevation is measured.

Hydrograph. A graph showing flow values against time at a given point, usually measured in cubic feet per second. The area under the curve indicates total volume of flow.

100-Year Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of runoff characteristics in the general region of the watershed.

500-Year Flood. A flood having an average frequency of occurrence in the order of once in 500 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of runoff characteristics in the general region of the watershed.

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Underclearance Elevation. The elevation at the top of the opening of a culvert, or other structure through which water may flow along a watercourse.



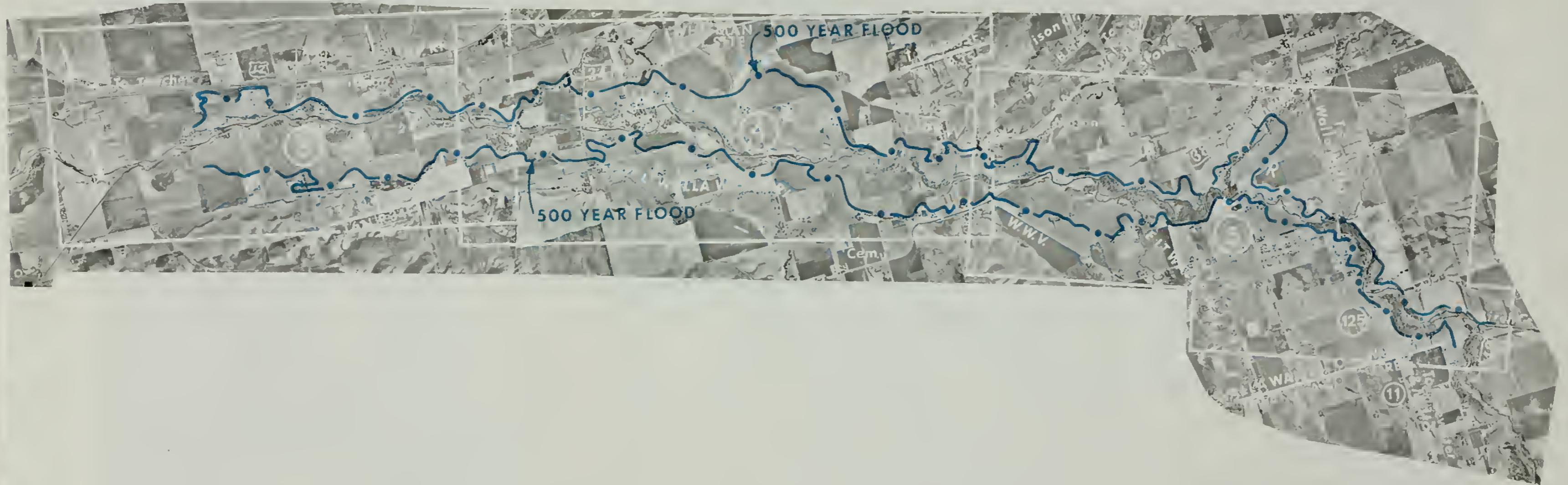


CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT

FLOOD PLAIN INDEX MAP

WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE

JUNE 1975



LEGEND

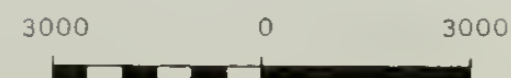
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PLATE NUMBER FOR FLOODED AREA MAPS

35

MILES ABOVE MOUTH OF WALLA WALLA RIVER

SCALE IN FEET (APPROX.)



NOTE: DATE OF PHOTOGRAPHY 18 JUNE 1973

CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT

FLOOD PLAIN INDEX MAP

WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE

JUNE 1975



LIMITS

OD } 500 YEAR FLOOD

OUTH

CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT
FLOOD PLAIN AREAS
WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE
JUNE 1975



SCALE IN FEET (APPROX)
 1000 0 1000 2000

NOTES:

1. LIMITS OF OVERFLOWS INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON THE GROUND, AS EXPLAINED IN THE REPORT.
2. RIVER MILES FROM C.B.I.A.C RIVER MILE INDEX, NOVEMBER 1966
3. U.S.C.E. PHOTOGRAPHY DATED 18 JUNE 1973.

LEGEND

OVERFLOW LIMITS



35 MILES ABOVE MOUTH

15 CROSS SECTION

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 FLOOD PLAIN AREAS
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LIMITS

FLOOD

500 YEAR
FLOOD

MOUTH

CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT
FLOOD PLAIN AREAS

WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE

JUNE 1975



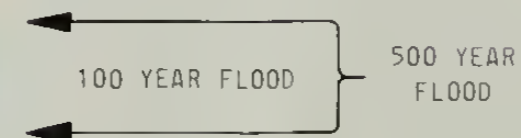
SCALE IN FEET (APPROX)
 1000 0 1000 2000

NOTES:

1. LIMITS OF OVERFLOWS INDICATED MAY VARY SOME FROM ACTUAL LOCATIONS ON THE GROUND, AS EXPLAINED IN THE REPORT.
2. RIVER MILES FROM C.B.I.A.C. RIVER MILE INDEX, NOVEMBER 1966.
3. U.S.C.E. PHOTOGRAPHY DATED 18 JUNE 1973.

LEGEND

OVERFLOW LIMITS



[35] MILES ABOVE MOUTH

[15] CROSS SECTION

CORPS OF ENGINEERS U.S. ARMY
 WALLA WALLA DISTRICT
 FLOOD PLAIN AREAS
 WALLA WALLA RIVER
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LIMITS



500 YEAR
FLOOD

MOUTH

N

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WALLA WALLA DISTRICT
FLOOD PLAIN AREAS

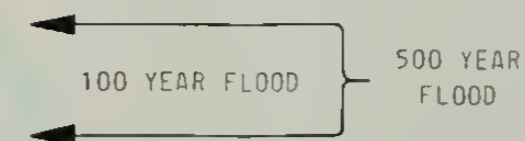
WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE

JUNE 1975



LEGEND

OVERFLOW LIMITS



35 MILES ABOVE MOUTH

15 CROSS SECTION

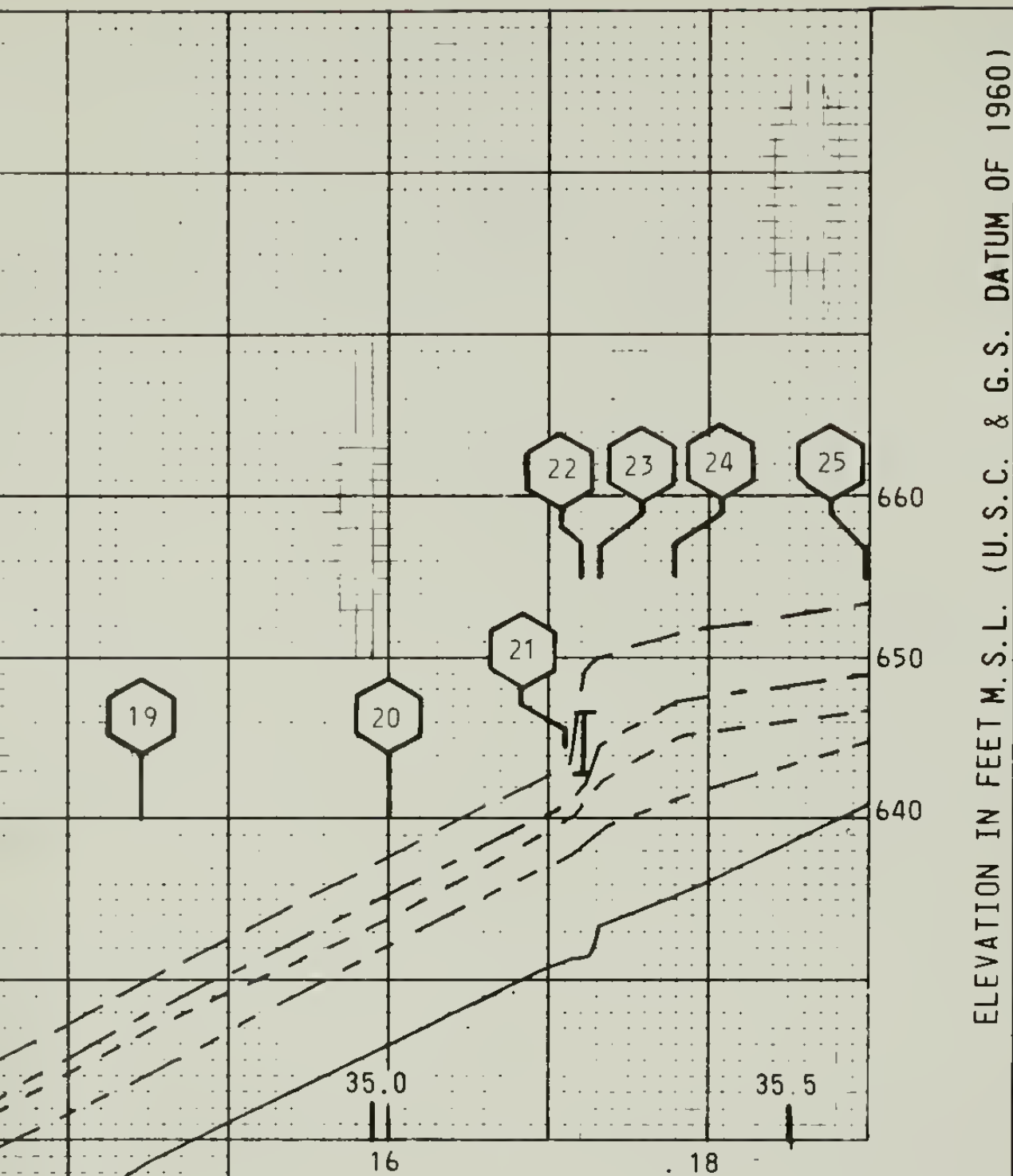
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3. U.S.C.E. PHOTOGRAPHY DATED 18 JUNE 1973.

SCALE IN FEET (APPROX)



CORPS OF ENGINEERS U.S. ARMY
WALLA WALLA DISTRICT
FLOOD PLAIN AREAS
WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATE LINE
JUNE 1975

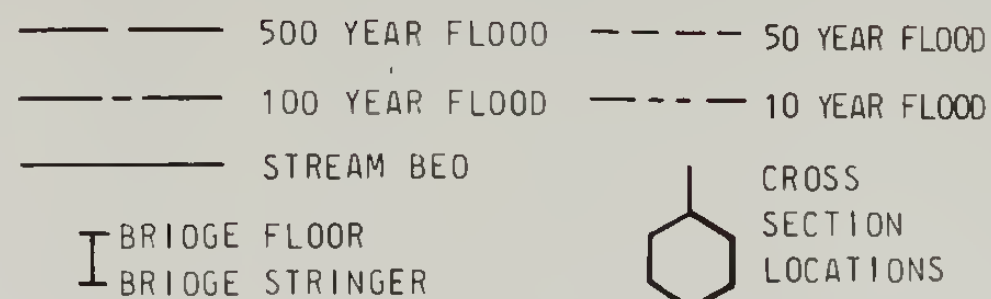


ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

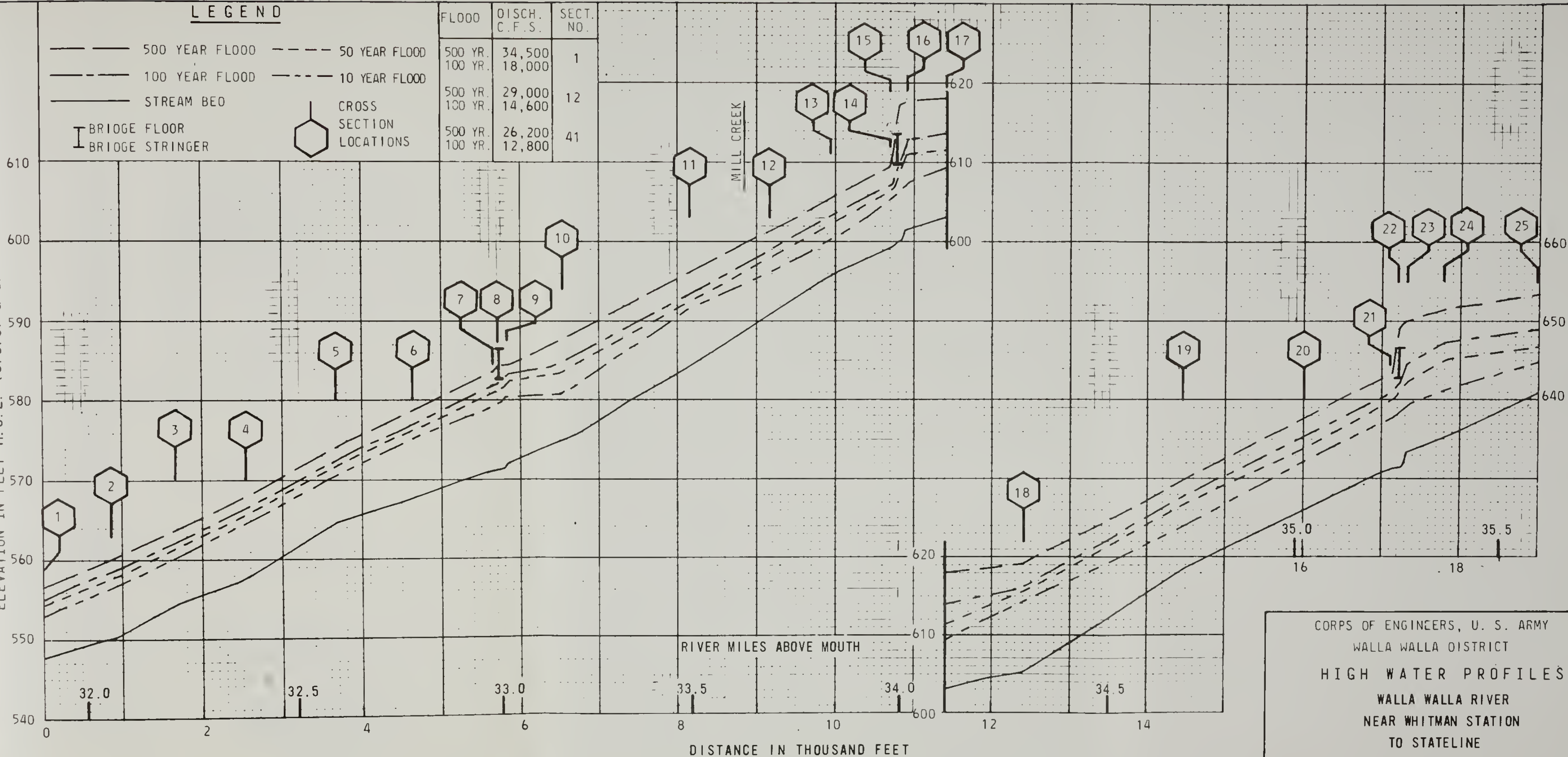
CORPS OF ENGINEERS, U. S. ARMY
WALLA WALLA DISTRICT
HIGH WATER PROFILES
WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATELINE
JUNE 1975

ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

LEGEND

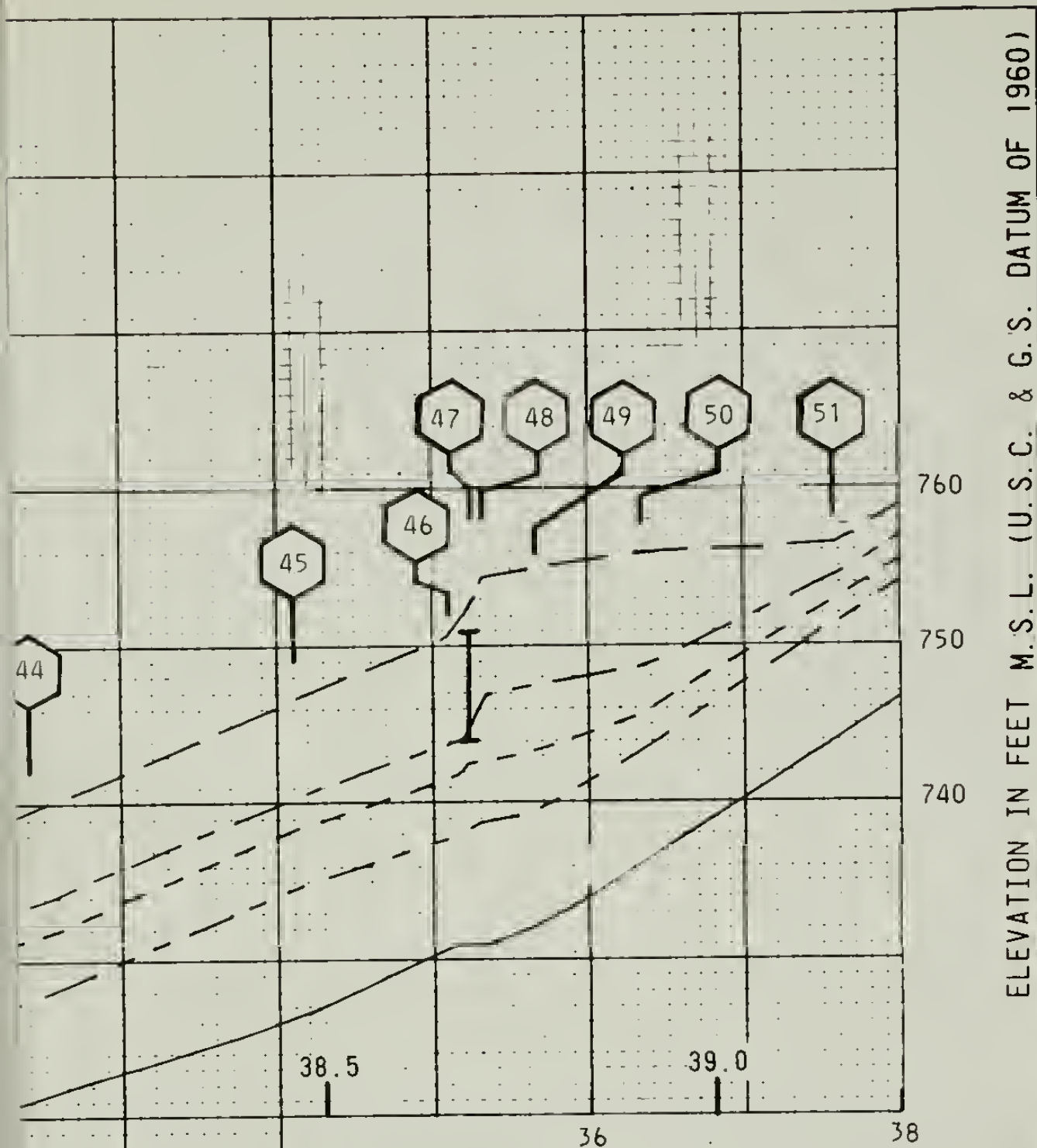


FLOOD	DISCH. C.F.S.	SECT. NO.
500 YR. 100 YR.	34,500 18,000	1
500 YR. 100 YR.	29,000 14,600	12
500 YR. 100 YR.	26,200 12,800	41



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ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

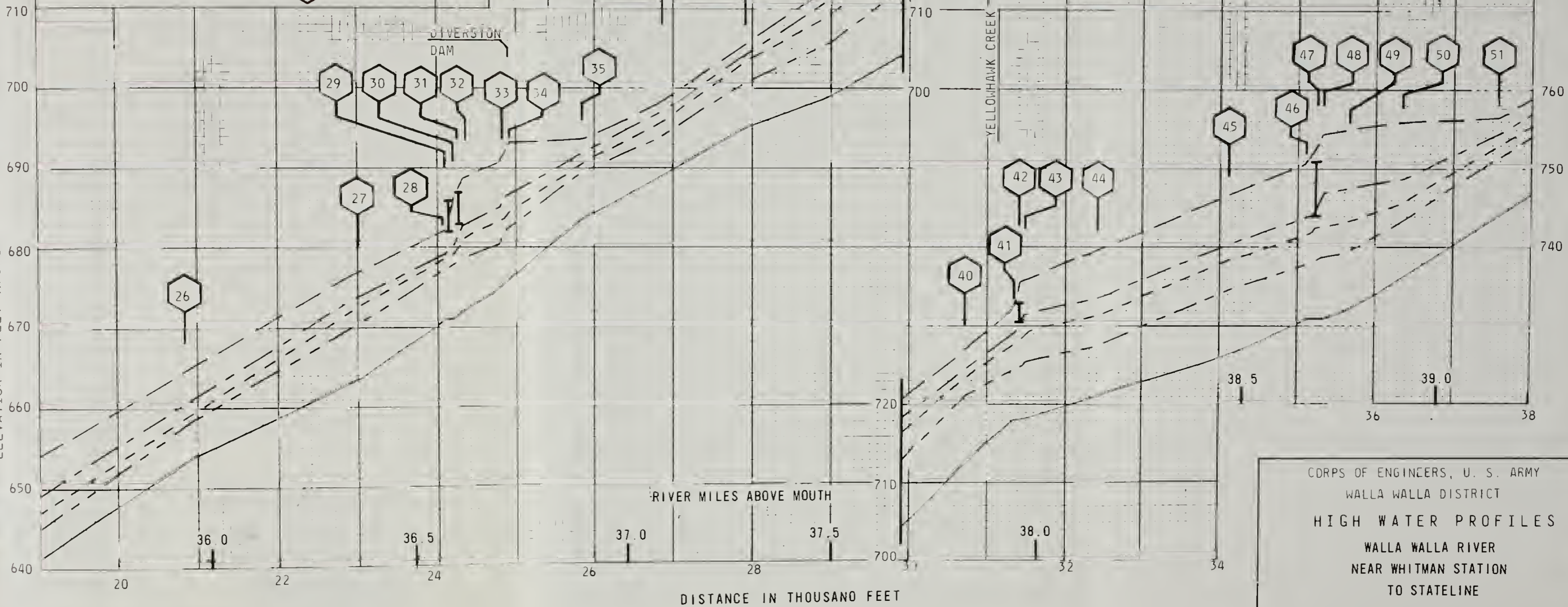


ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

LEGEND

- 500 YEAR FLOOD - - - 50 YEAR FLOOD
- - - 100 YEAR FLOOD - - - 10 YEAR FLOOD
— STREAM BED
I BRIDGE FLOOR
I BRIDGE STRINGER
CROSS SECTION LOCATIONS

FLOOD	DISCH. C.F.S.	SECT. NO.
500 YR.	34,500	1
100 YR.	18,000	
500 YR.	29,000	12
100 YR.	14,600	
500 YR.	26,200	41
100 YR.	12,800	



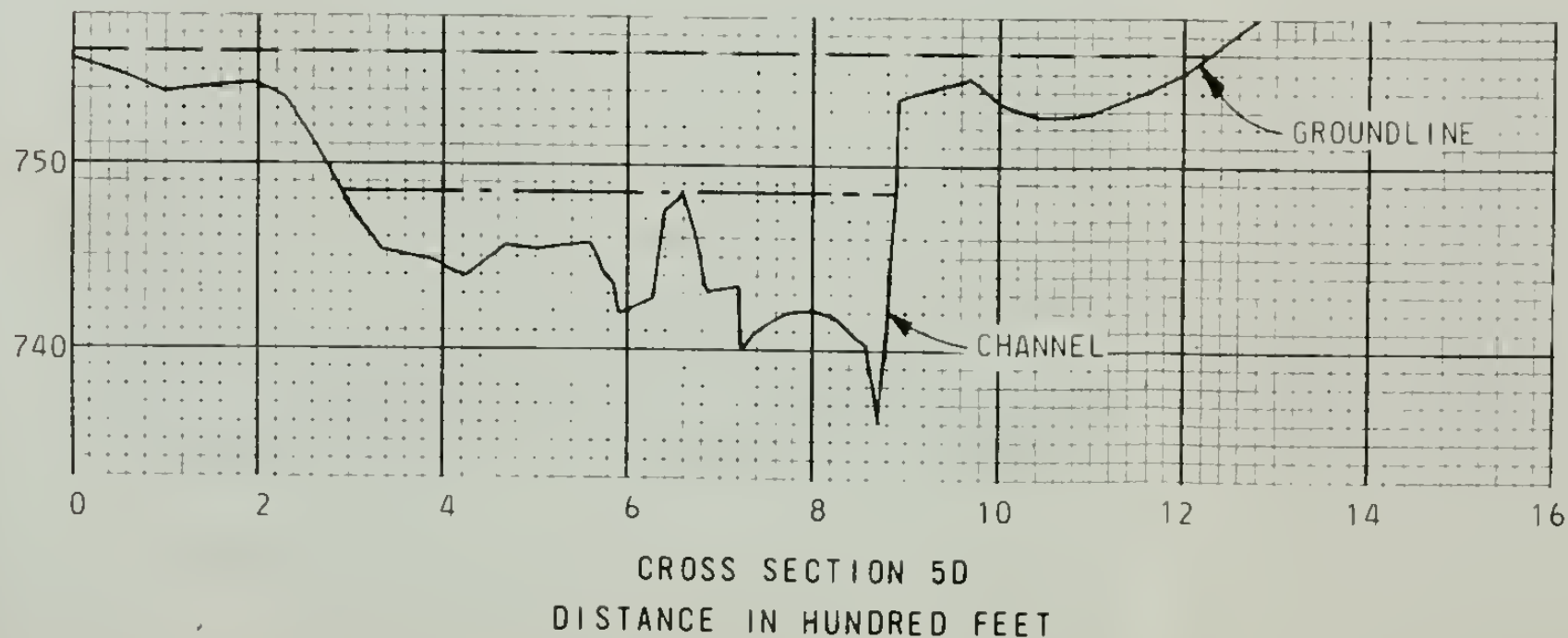
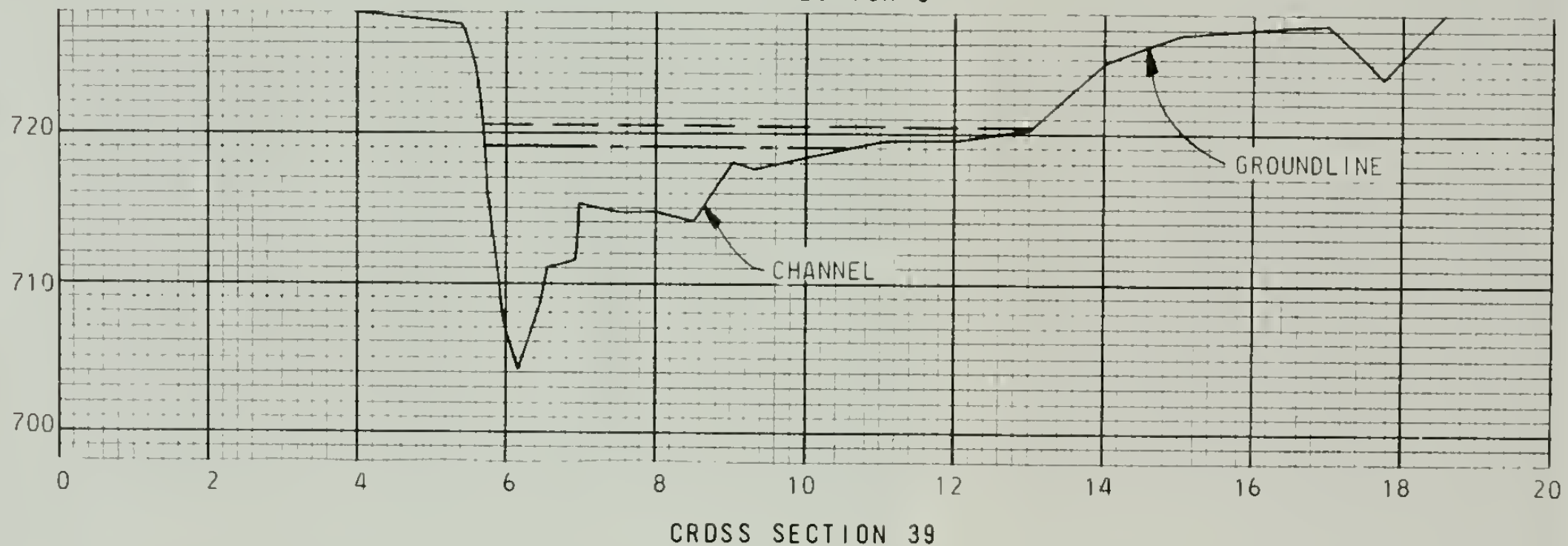
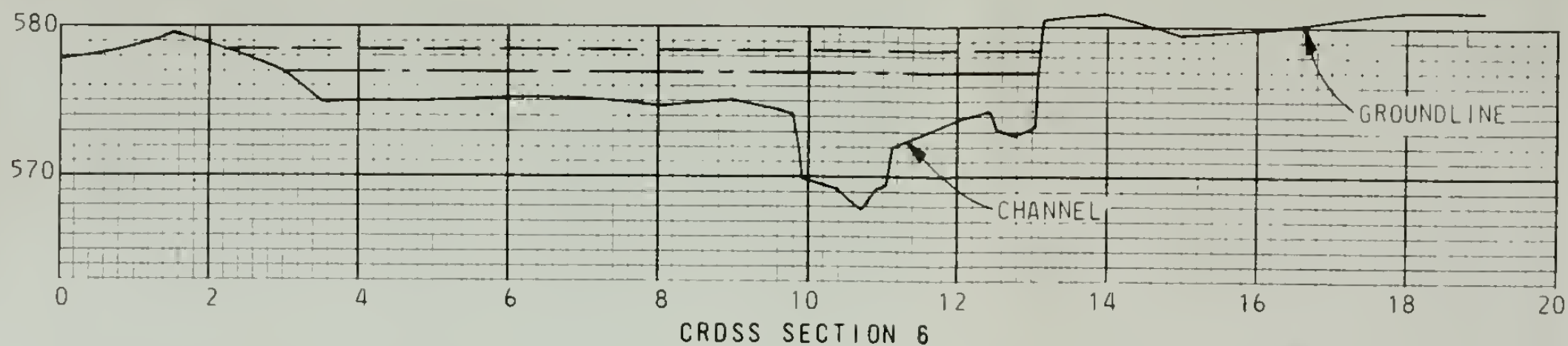
ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

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HIGH WATER PROFILES
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ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)

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ELEVATION IN FEET M.S.L. (U.S.C. & G.S. DATUM OF 1960)



LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD

NOTE:

SECTIONS SHOWN LOOKING DOWNSTREAM.

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WALLA WALLA DISTRICT

CROSS SECTIONS
WALLA WALLA RIVER
NEAR WHITMAN STATION
TO STATELINE
JUNE 1975

